

What is claimed:

INSD 1  
A 2

1. A method for forming conducting structures separated by gaps on a substrate comprising:

providing a substrate and a wiring line layer above the substrate;

5 forming a first antireflective coating on the wiring line layer;

forming a second antireflective coating on the first antireflective coating, wherein the first antireflective coating and the second antireflective coating are formed from different materials;

10 etching through a portion of the first antireflective coating, a portion of the second antireflective coating, and a portion of the wiring line layer to form wiring lines separated by gaps; and

depositing a dielectric material within the gaps between the wiring lines.

2. The method of claim 1, wherein the first antireflective coating works primarily by absorption and the second antireflective coating works primarily by interference.

15 3. The method of claim 1, wherein the dielectric material within the gaps is deposited using high density plasma chemical vapor deposition.

20 4. The method of claim 3, wherein a portion of the second antireflective coating is etched during the high density plasma chemical vapor deposition.

25 5. The method of claim 1, further comprising the formation of a surface layer between the substrate and the wiring line layer, the surface layer being a barrier between the substrate and wiring line layer.

6. The method of claim 1, further comprising the step of removing the second antireflective coating after the deposition of a dielectric material within the gaps.

7. The method of claim 1, wherein part of the second antireflective coating is removed and remaining portions of the second antireflective coating act as a mask during the etching of the first antireflective coating and the wiring line layer.

5 8. The method of claim 1, wherein after etching each wiring line has a portion of the second antireflection coating thereon, the portion of second antireflection coating on each wiring line having a cross-sectional shape selected from the group consisting of a rectangle, a triangle, a trapezoid, and a rectangle having its upper corners etched away.

10 9. A method for forming conducting structures separated by gaps on a substrate comprising:

providing a substrate and a wiring line layer above the substrate;

forming a cap layer above the wiring line layer;

15 etching through a portion of the cap layer and a portion of the wiring line layer to form wiring lines separated by gaps, the wiring lines having a remaining portion of the cap layer thereon; and

depositing a dielectric material using high density plasma chemical vapor deposition within the gaps between the wiring lines at a sputtering rate sufficient to fill the gaps.

20 10. The method of claim 9, wherein the cap layer is used as a hard mask during etching of the wiring line layer.

11. The method of claim 9, wherein the cap layer is an antireflective coating.

25 12. The method of claim 9, wherein the remaining portion of the cap layer is partially etched during the deposition of a dielectric material using high density plasma chemical vapor deposition.

30 13. The method of claim 9, wherein the cap layer comprises a material selected from the group consisting of a silicon nitride material and an oxynitride material.

14. The method of claim 9, wherein the remaining portion of the cap layer on at least one wiring line has a rectangular shape in cross section.

5 15. The method of claim 9, wherein the remaining portion of the cap layer on at least one wiring line has a trapezoidal shape in cross section.

10 16. The method of claim 15, wherein the trapezoidal shape includes top and bottom surfaces parallel to one another and side surfaces that extend inwardly from the bottom surface to the top surface.

17. The method of claim 9, wherein the remaining portion of the cap layer on at least one wiring line has a triangular shape in cross section.

15 18. The method of claim 9, wherein the remaining portion of the cap layer on at least one wiring line has, in cross section, a rectangular shape having its upper corners etched away.

20 19. The method of claim 9, wherein the remaining portion of the cap layer is partially etched and redeposited into the gaps during the high density plasma chemical vapor deposition process.

20. A method for forming conducting structures separated by gaps filled with dielectric material, comprising the steps of:

providing a substrate containing silicon, the substrate having a surface;

forming a surface layer comprising at least one material selected from the group  
5 consisting of titanium nitride, titanium silicide and a titanium-tungsten alloy, the surface layer disposed on the substrate surface;

forming a metal wiring layer on the surface layer, the metal wiring layer having an upper surface;

forming a protective layer comprising at least one material selected from the group  
10 consisting of titanium nitride, titanium silicide and a titanium-tungsten alloy, the protective layer disposed on the upper surface of the metal wiring layer, the protective layer having a top surface;

forming a cap layer comprising at least one material selected from the group consisting of an oxide, a nitride, and an oxynitride, the cap layer disposed on the top surface of the protective layer;

15 forming a patterned photoresist layer above the cap layer, said patterned photoresist layer covering selected portions of the cap layer and exposing other portions of the cap layer;

etching the exposed portions of the cap layer, the protective layer and the metal layer to form wiring lines separated by gaps;

forming a layer of high density plasma chemical vapor deposition dielectric material  
20 within the gaps.